

CHAPTER 11-7 AQUATIC INSECTS: HEMIMETABOLA – HEMIPTERA

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CHAPTER 11-7

AQUATIC INSECTS:

HEMIMETABOLA – HEMIPTERA



Figure 1. *Pachybrachius luridus*, a species of bogs and fens. Photo by Tristan Bantock, with permission.

HEMIPTERA – True Bugs, Cicadas, Hoppers, Aphids, and Allies

Aquatic bryophyte dwellers are rare in this insect order. Most members are either free swimming or skate on the top of the surface tension. However, bogs and bog pools do provide a suitable habitat for some species. Rédei *et al.* (2003) found no specificity for species among *Sphagnum* (Figure 2) or any species that was characteristic for that moss. *Ceratocombus coleoptratus* (Figure 6-Figure 7) and *Hebrus ruficeps* (Figure 13) had the highest dominance in that habitat, with *Cryptostemma pusillum* (Figure 3), *Saldidae* (Figure 27-Figure 31), and *Miridae* (Figure 4) also occurring here. They considered the similarity of the bog community to that of the soil moss community to be due to the low relative dominance of larvae from the large family *Lygaeidae* (Figure 32-Figure 37) in both habitats.

Members of this family lack gills and their immature stages are nymphs, placing them in the **Hemimetabola**. Some breathe by a **plastron** (mechanism for carrying an air layer next to the body).



Figure 2. *Sphagnum fuscum*, a genus that is home for a few members of the **Hemiptera**. Photo by Michael Lüth, with permission.



Figure 3. *Cryptostemma* sp. *Cryptostemma pusillum* is among the **Hemiptera** with the highest dominance in bogs. Photo by Michael F. Schönitzer, through Creative Commons.



Figure 4. *Campyloneura virgula* (Miridae), a dominant species in bogs. Photo by Valter Jacinto, through Creative Commons.

Cicadellidae – Leafhoppers

This family was previously placed in the Homoptera, but is now included in the order **Hemiptera**. It is not, however, a true bug.

This is the second largest hemipteran family. The members live primarily on land (Leafhopper 2015). They use the hairs on their legs to facilitate a secretion over their bodies that acts as a water repellent and carrier of pheromones. They obtain their food by sucking sap from a variety of plants.

Megophthalmus scanicus (Figure 5; 3-4 mm) is a widespread species in the UK where it overwinters among mosses (Edwards 1874-1879). This is a species of wide habitat variety, including both wet and dry habitats.



Figure 5. *Megophthalmus scanicus* nymph, a species that overwinters among mosses. Photo from <www.biolib.cz>, through public domain.

Ceratocombidae

The **Ceratocombidae** is mostly tropical and lives primarily in leaf litter along water margins. This is a group of small bugs, 1.5-3.0 mm, mostly dull-colored, from yellowish to dark brown (Livermore & Rider 2015). These insects require permanently damp conditions such as those provided by the wet mosses close to running water. Members of this family overwinter as adults, requiring the permanent wetness of habitats like wet mosses near running water (Howe 2004). *Ceratocombus brevipennis* (see Figure 6) is one of these moss dwellers in central and southern Europe (Michael Münch personal communication 30 October 2014).



Figure 6. *Ceratocombus coleoptratus*, an inhabitant of wet mosses in Europe. Michael Münch <www.insekten-sachsen.de>, with permission.

Ceratocombus coleoptratus (Figure 7) was rare in the UK even as early as the 1870's (Edwards 1874-1879). It lives among mosses, perhaps being under-collected and accounting for its presumed rarity. Fortunately it still

exists, living in moss cushions, needle litter, and dead plant material at the edges of forests (Münch 2012). It also occasionally lives in moss beds in swampy meadows.



Figure 7. *Ceratocombus coleoptratus* wending its way through its moss home. Photo by Michael Münch, with permission.

Dipsocoridae – Jumping Ground Bugs

This family (Figure 3) of tiny bugs (2-3 mm) is found mostly among wet mosses by running water in Wales (Howe 2004). These bugs, despite their small size, are predators with rapid movements that typically live near streams and rivers.

In particular, some species of the genus *Pachycoleus* are closely associated with bryophytes in central and southern Europe (Michael Münch pers. comm. 30 October 2014). In Wales, it is *Pachycoleus waltli* that is common among the wet mosses (Howe 2004). Kment *et al.* (2013) found *P. waltli* among wet mosses that covered dead branches along a stream. This species is typical of permanently wet to very wet moss [*Sphagnum* (Figure 2), *Hypnum* (Figure 8), *Brachythecium* (Figure 9), *Cratoneuron* (Figure 10)] and may stay fully submerged.



Figure 8. *Hypnum cupressiforme*, a home for *Pachycoleus waltli*. Photo by Li Zhang, with permission.



Figure 9. *Brachythecium plumosum*, a home for *Pachycoleus waltli*. Photo by Janice Glime.



Figure 10. *Cratoneuron commutatum*, a wet habitat where one might find members of the genus *Pachycoleus*. Photo by Michael Lüth, with permission.

Using Berlese funnels to sample in Hungarian bogs, Rédei *et al.* (2003) found *Cryptostemma pusillum* (Figure 3) among the common **Hemiptera**.

Gerridae – Water Striders

The most distinctive feature of the **Gerridae** is their ability to skate about on the water surface. They are larger (~4-18 mm) than the other surface bugs described here. Their skating ability is possible due to hydrofuge (water-repelling) hairs, retractable claws, and long legs (Ward 1992). The hairs are arranged in hair piles with more than 1000 microhairs per mm. They cover the entire body, repelling water drops that could otherwise weigh them down.

Gerris is not a genus that finds mosses important in the water, instead skating on its surface. To my surprise, I read an old report of *Gerris lacustris* (Figure 11) hibernating under a terrestrial moss nearly a km from water! (Butler 1886). This species is a water strider – the spider-like insect that skates on the surface tension of quiet pools of ponds and streams. Furthermore, *Gerris argentatus* (Figure 12) occurs among wet mosses (Edwards 1874-1879).



Figure 11. *Gerris lacustris* on pond, a species that hibernates under terrestrial mosses. Photo by Jakub Rom through public domain.



Figure 12. *Gerris argentatus*, a species that can be found among wet mosses. Photo by Niels Sloth, with permission.

Hebridae – Sphagnum Bugs, Velvet Water Bugs

The **Hebridae** are small insects (1.3-3.7 mm) of semiaquatic habitats, living mostly in moist detritus or among floating plants, wet moss, or margins of still waters (McClarin 2006). The **Hebridae** are most common among wet mosses (Howe 2004) and the genus *Hebrus* lays its eggs among mosses, hiding them in leaf axils, or between closely spaced leaves, where it uses a gelatinous glue to adhere them (Polhemus & Chapman 1979a). In the bogs and fens of Hungary the diversity of **Hemiptera** is very low when a large spatial area is considered (Rédei *et al.* 2003). This is because one wet moss species, *Hebrus ruficeps* (Figure 13), dominates, comprising 90% of the **Hemiptera** fauna!



Figure 13. *Hebrus ruficeps*, a moss dweller in *Sphagnum* bogs that is able to survive the winter frozen in ice at the water surface. Photo by Ruth Ahlburg, with permission.

Members of *Hebrus* are small bugs, only 1.3-3.7 mm long (Ramel 2014). Their preferred habitat is ponds with *Sphagnum* (Figure 14) or along margins of streams. Although the genus has about 150 species worldwide, mostly in tropical environments of Southeast Asia, the UK has only two species, both moss dwellers.



Figure 14. *Sphagnum cuspidatum*, in a genus that is home to *Hebrus* in ponds. Photo by Blanka Shaw, with permission.

Hebrus concinnus was observed laying its eggs between the leaves of mosses where the eggs were partially concealed (Hungerford 1920). Edwards (1874-1879) reported *Hebrus pusillus* (Figure 15) from wet moss. Münch (2013) likewise considered *H. pusillus* a moss dweller, but that it also lives on the water surface and at the edge of the water where it reproduces. Howe (2004) reported that it is associated with *Sphagnum* (Figure 2, Figure 14) and other mosses.



Figure 15. *Hebrus pusillus* on a moss. Photo by Michael Münch, with permission.

But not all members of *Hebrus* live along streams. *Hebrus pusillus* (Figure 15) and *H. ruficeps* (Figure 13) both occur among *Sphagnum* (Figure 2) in bogs (Butler 1886). *Hebrus ruficeps* is able to survive the winter frozen in ice at the water surface (Ramel 2014). Butler (1886) recommended tearing a handful of the moss into small pieces and examining each carefully to find these tiny bugs.

The genus *Merragata* (Figure 16), like *Hebrus*, lays its eggs on moss leaves, or under algae, where they incubate for 8-12 days (Polhemus & Chapman 1979a).



Figure 16. *Merragata hebroides*, a genus that lays its eggs on moss leaves or under algae. Photo by Don Loarie, through Creative Commons.

Mesoveliidae – Water Treaders

These are small usually greenish or yellowish surface bugs of about 2-5 mm length. *Mesovelia mulsanti* (Figure 17) prefers lakes and bogs with lots of surface vegetation where they live on mosses and other floating plants (Figure 18; Menke 1979). They feed on lily pads and easily run on the surface of the water. *Mesovelia amoena* (Figure 19), on the other hand, occurs on mosses in hot spring caves of Death Valley and avoids the water unless disturbed (Hungerford 1917; Polhemus & Chapman 1979b). At least some populations must be **parthenogenetic** (giving birth without fertilization) because only the female of *Mesovelia amoena* occurs in Hawaii.



Figure 17. *Mesovelia mulsanti*, a bog dweller. Photo by Matt Bertone, through Creative Commons.



Figure 18. *Mesovelia* sp. blending with several floating duckweed species. Photo by Steve Nanz, through Creative Commons.



Figure 19. *Mesovelia amoena*, a moss dweller, including those in a hot spring cave. Photo by Dana R. Denson, Florida Association of Benthologists, with permission.

Veliidae – Small Water Striders, Riffle Bugs

The family **Veliidae** (1-12 mm) is best adapted for surface activity, walking easily on the surface tension. The surface tension facilitates their detection of food items (small arthropods) by vibrating as the prey organisms move about (McLeod 2005).

In my studies of Appalachian Mountain, USA, stream bryophyte inhabitants, *Microvelia* (Figure 20-Figure 22) was the only member of **Hemiptera** that I found (Glime 1968). The genus *Microvelia* has a unique means of locomotion. Instead of clambering about on the water surface by paddling with its middle legs like other **Hemiptera**, it exudes a fluid that reduces the surface tension in the water behind it. This causes the surface there to expand and push it forward.

Microvelia and *Paravelia* species lay their eggs on such floating objects as moss, duckweed, and living or dead leaves just above or below the water surface (Polhemus & Chapman 1979d). *Microvelia reticulata* (Figure 20) overwinters as an adult (Ramel 2014). It lays eggs in mosses and feeds on tiny invertebrates, including mosquito eggs.



Figure 20. *Microvelia reticulata*, a species that lays its eggs among mosses. Photo by Niels Sloth, with permission.

Microvelia buenoi (Figure 21) lives among mosses at the edge of a pond in Indiana, USA (Bamd 2007), where it was sampled using a Berlese funnel. In Florida, Herring (1950) found *Microvelia hinei* (Figure 22) in mats of *Sphagnum* (Figure 14) in acid swamps and bog streams. This species illustrates a short incubation time of only 6.41 days (mean) (Taylor & McPherson 2003). Nymphal development requires only 25 days for its 5 instars (developmental stages).



Figure 21. *Microvelia buenoi*, a species that occurs among mosses at the edge of a pond. Photo by Tim Faasen, with permission.



Figure 22. *Microvelia hinei*, an inhabitant of *Sphagnum* mats in bogs. Photo from Biodiversity Institute of Ontario, through Creative Commons.

Macroveliidae – Macroveliid Shore Bugs

This new world family never exceeds 5 mm in length. *Macrovelia hornii* (Figure 23; ~4.2 mm) nymphs and adults live among mosses and other floating vegetation at the water's edge in protected niches behind rocks or logs or among debris (Usinger 1956; Menke 1979). Polhemus and Chapman (1979c) consider this species to be common among the mosses of California springs and seeps. They lay their eggs glued to wet mosses (Menke 1979).



Figure 23. *Macrovelia* sp. Some species live among mosses in crevices at the water's edge. Photo by Paul A. Rude, through Creative Commons.

Corixidae – Water Boatmen

This family ranges 2-14 mm and is free-swimming in ponds and slow-moving streams (Corixidae 2014). Thus, they are not typically among the bryophyte dwellers. Unlike most aquatic Hemiptera, they are predominantly herbivores, feeding on algae and aquatic plants. And, Macan and Maudsley (1968) report *Micronecta poweri* (Figure 24) to be associated with vegetation, including *Fontinalis* (Figure 25). The Corixidae inject enzymes into the plants (or animals) through the strawlike mouthparts (Figure 26), then suck the cell contents back through that same straw (Corixidae 2014).



Figure 24. *Micronecta poweri*, a water boatman that sometimes lives among *Fontinalis*. Photo by Urmas Kruus, with permission.



Figure 25. *Fontinalis antipyretica*, a genus that is home to *Micronecta poweri*. Photo by Bas Kers, through Creative Commons.



Figure 26. **Corixidae** eating mosquito pupa. Photo by Bob Armstrong, with permission.

Saldidae – Shore Bugs

The **Saldidae** are small to medium in size (2-8 mm) (Saldidae 2013). *Salda* (Figure 27) is known as a bog-moss dweller at pond margins (Butler 1886). *Salda morio* and *S. muelleri* live in bog pond margins (Spunĝis 2009) among mosses (Michael Münch pers. comm. 30 October 2014). *Salda littoralis* occurs in salt marshes and tidal zones, where it hides under marine algae at low tide and migrates to the edge of the water in high tide, but it also lives in freshwater habitats (Spunĝis 2009) where it often associates with bryophytes, including living among *Sphagnum* (Figure 14) in a mountain lake in the Italian Alps (Michael Münch pers. comm. 30 October 2014). It will occasionally submerge into the water (Polhemus 1976).



Figure 27. *Salda lugubris*, member of a genus that has bog moss dwellers. Photo by Dana R. Denson, Florida Association of Benthologists, with permission.

Saldula pallipes (Figure 28) lays its eggs at the bases of mosses or in between their leaves at the edges of ponds (Usinger 1956).



Figure 28. *Saldula pallipes* lays its eggs at the bases or between leaves of mosses at the edges of ponds. Photo by Charlie Eiseaman, through Creative Commons.

Chartoscirta cocksii (= *Salda cocksii*; Figure 29) lives in ponds, mossy areas, and wetlands. Michael Münch (pers. comm. 30 October 2014) found it in a swamp among a taller moss (not *Sphagnum*). In early surveys, *Chartoscirta cocksii* was the primary hemipteran among *Sphagnum* (Figure 2, Figure 29) in the UK (Butler 1886). This tiny black bug has huge eyes and stout antennae, making a striking find. Butler recommends putting mud, mosses, and dead leaves in a box to watch how many saldids will hatch out. This species will also take an occasional dip in the pools of the bog (Polhemus 1976).



Figure 29. *Chartoscirta cocksii* on *Sphagnum papillosum*. Photo by Barry Stewart, with permission.

Chartoscirta elegantula (Figure 30) occurs between tide marks, but it also can be common among *Sphagnum* (Figure 2) (Michael Münch pers. comm. 30 October 2014). Like *Gerris lacustris*, it migrates to overwinter in dry moss or leaves on land far from its summer habitat.



Figure 30. *Chartoscirta elegantula elegantula*, a species that often migrates from the intertidal zone to overwinter among dry mosses. Photo by Sanjo, through Creative Commons.

Ioscytus nasti (Figure 31) occurs in bogs in North America (Usinger 1956). This is a poorly known genus and may provide some surprises in the bogs.

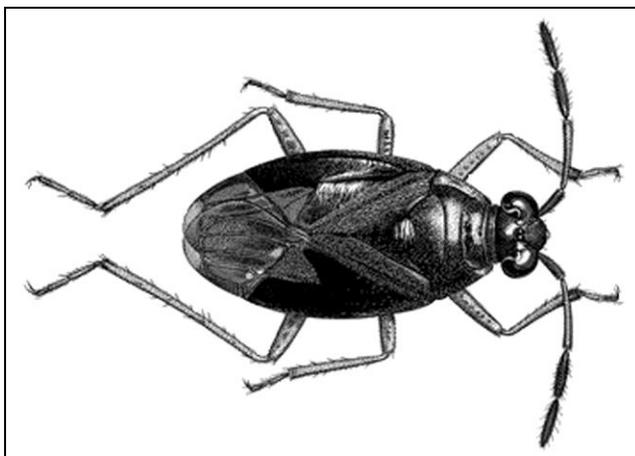


Figure 31. *Ioscytus nasti*, a bog inhabitant. Image from Smithsonian Institution, through Creative Commons.

Lygaeidae – Seed Bugs, Cinch Bugs

This family of bugs, ranging 4-20 mm (Lygaeidae 2015), feeds primarily on seeds. Hence, bryophytes do not provide an ideal habitat. Nevertheless, the family has several bog and fen dwellers (Michael Münch pers. comm. 30 October 2014). Among these are *Scolopostethus pilosus* (Figure 32) in calcareous fens, *Cymus glandicolor* (Figure 33) in fens, *Ligyrocoris sylvestris* (Figure 34) in hill moors, *Pachybrachius luridus* (Figure 35) in bogs and fens, *P. fracticollis* (Figure 36) rare in bogs, fens, and wet meadows (Spunĝis 2009), all among mosses (Michael Münch pers. comm. 30 October 2014). *Scolopostethus puberulus* (Figure 37), on the other hand, lives primarily in deciduous forests, but also in **mesic** meadows (environment with moderate amount of moisture) (Spunĝis 2009), as a moss dweller (Michael Münch pers. comm. 30 October 2014).



Figure 32. *Scolopostethus pilosus*, a moss dweller in calcareous fens. Photo by Boris Loboda, with permission.



Figure 33. *Cymus glandicolor*, a moss dweller in fens. Photo by Tristan Bantock, with permission.



Figure 34. *Ligyrocoris sylvestris*, a moss dweller in hill moors. Photo by Tom Murray, through Creative Commons.



Figure 35. *Pachybrachius luridus*, a moss dweller in bogs and fens. Photo by Tristan Bantock, with permission.



Figure 36. *Pachybrachius fracticollis*, a rare moss dweller in bogs, fens, and wet meadows. Photo by Barry Stewart, with permission.



Figure 37. *Scolopostethus puberulus*. Photo by Michael Münch <www.insekten-sachsen.de>, with permission.

Rhyparochromidae – Dirt-colored Seed Bugs

Like the Lygaeidae, the **Rhyparochromidae** feed primarily on seeds, making bryophytes less than ideal habitats. *Rhyparochromus pini* (Figure 38) has adults 7-8

mm in length (British Bugs 2015). Most in Great Britain live in heathland, often under the heath; others live on sand dunes. However, Spun̄gis (2009) found that this species also lives in bogs and fens.



Figure 38. *Rhyparochromus pini* nymph, an inhabitant of bogs and fens. Photo by Tristan Bantock, with permission.

Summary

The Homoptera have been moved into the order **Hemiptera** and the family **Cicadellidae** has a few members that use wet mosses to overwinter.

The true bugs have more aquatic members, but few are true bryophyte dwellers. The families **Ceratocombidae** and **Dipsocoridae** require permanently damp conditions and therefore many live in wet mosses. The surface-dwelling **Gerridae** sometimes spend the winter far from water among bryophytes. The **Hebridae** are frequent bryophyte dwellers among wet mosses and some lay their eggs there; others live in bogs. **Mesoveliidae** occur in lakes, bogs, and among mosses of hot spring caves. Some **Veliidae** lay their eggs on mosses and live among them in pools, acid swamps, and bog streams. Macroveliidae are more terrestrial but may live among mosses as nymphs. The **Saldidae** have some species that prefer bog pond margins among the mosses; others live among the taller bog bryophytes. Even the **Lygaeidae** and **Rhyparochromidae** occur among mosses in bogs. The larger, free-swimming **Corixidae** can occur among *Fontinalis* in slow-moving water.

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